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# Capital Immobilities and Industrial Development: A Comparative Study of Brazil, Mexico, and the United States, 1840-1930

**November 1994**

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**Working Paper No. 139**

This publication was made possible through support provided by the U.S. Agency for International Development, under Cooperative Agreement No. DHR-0015-A-00-0031-00.

The views and analyses in the paper do not necessarily reflect the official position of the IRIS Center or the U.S.A.I.D.

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Abstract

Capital Immobilities and Industrial Development: A Comparative Study of Brazil, Mexico, and the United States, 1840-1930

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This paper builds upon my earlier papers on capital markets and industrial development. It argues that there is a strong relationship between the efficiency with which a country mobilized capital for industrial development and the industrial structure that country developed. Differences in capital market development were a function of government regulatory policies and the costs of obtaining information. The analysis suggests that the development of financial institutions is not endogenous to the process of economic growth: the legal tradition and the regulatory environment exert powerful indcpcndcnt effects.

The argument is demonstrated through an analysis of the financing and development of the cotton textile industry in three countries: Brazil, Mexico, and the United States during their early periods of industrial development. The paper first compares the institutional history of financial intermediaries and textile mill financing in the four countries during the period 1840 to 1930. The paper then assesses changes in the size and structure of each country's textile industry in light of their histories of industrial finance. It presents data sets on industrial structure (measured both as four firm concentration ratios and Herfindahl indices) covering the period 1840-1930. This section of the paper also develops a counter-factual model to estimate the loss to Mexico of its repressive financial market regulatory policies.

The paper concentrates on the cotton textile industry because it was the most important industry in Brazil and Mexico during the period under consideration. In addition, the cotton textile industry should be characterized by near-perfect competition because of the high degree of divisibility of capital, small minimum efficient scales, and lack of legal or technological barriers to entry. High levels of concentration can therefore easily be tied to differential access to capital.

The analysis presents a number of striking conclusions. The first is that by the standards of LDCs, Brazil had surprisingly large and vibrant markets for industrial finance. Not only was there a stock market in which many of the large firms sold equity, there was a well developed bond market as well. In fact, from 1905 to 1915 nearly one-third of all new additions to capital in the Brazilian textile industry were financed through the sale of long-term debt. Thus, there have been periods in the past in which LDC's have had well developed financial markets.

Second, in the case of Mexico government regulatory policies gave rise to imperfections in the markets for both short term debt and long term equity finance. In fact, only four percent of Mexico's cotton textile firms were able to use the equity markets to raise capital as opposed to 32 percent of firms in Brazil, The result was differential access to capital: some entrepreneurs were able to get all the finance they wanted while everyone else was starved for funds. Access to capital therefore acted as a barrier to entry: the same four firms that sold equity on the stock exchange controlled nearly one-third of installed capacity in the industry. At their peak, these same four firms controlled nearly 40 percent of the domestic textile market.

Third, differences in industrial structure between Brazil, Mexico, and the United States were not a function of industry size. Mexico's high levels of concentration cannot be explained as a consequences of the relatively small size of its industry. Econometric analysis indicates that Mexico's largest manufactures had no productivity advantage over their smaller competitors. They were not large because they were capturing scale economies, they were large simply because they were able to obtain impersonal sources of finance and outgrow their competitors.

Finally, Mexico's surprisingly high levels of concentration may have had consequences for productivity growth. In an economy characterized by the lack of either domestic or international competition (because of high tariffs), there was little incentive for the largest firms in the industry to innovate. The evidence analyzed to date indicates that once Mexico's largest firms obtained market dominance, their managers sat back, earned rents from their privileged position, and watched their market shares slowly decline. The end result was a slow rate of investment in new plant and equipment

The implications of the work are the following. First, government regulatory policies have profound effects on the size and structure of financial markets in LDCs. The high costs of cooperation and coordination in LDCs means that the private sector has a difficult time mitigating government attempts to constrain its activities. Second, the size and structure of financial markets exert a powerful influence on the size and structure of industry. Imperfections in capital markets can give rise to imperfections in product markets. Third, imperfections in product markets, coupled with protectionist commercial policies, mean that inefficient industries can persist over long periods of time.

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Abstract:
This paper argues that there is a strong relationship between the efficiency with which a country mobilized capital for industrial development and the industrial structure that country developed. Differences in capital market development were a function of government regulatory policies and the costs of obtaining information. The analysis suggests that the development of financial institutions was not endogenous to the process of economic growth: the legal tradition and the regulatory environment exerted powerful independent effects.

Financial support for this research was generously provided by the Institutional Reform and the Informal Sector (IRIS) Center at the University of Maryland, the Center for U.S.-Mexican Studies at the University of California, San Diego, the Social Science Research Council, and Stanford University's Center for Latin American Studies and Institute for International Studies.

. A shortened version of this paper will appear in Colin Lewis and Janet Hunter eds., Public Choice and Third world Development (currently under review at Routledge).

Michael Postan, the economic historian of the middle ages, once remarked that the entire English industrial revolution of the eighteenth and early nineteenth centuries could have been financed single-handedly by any one of Europe's medieval millionaires. The problem of finance during the early stages of industrialization, as Postan correctly pointed out, was not one of the accumulation of capital so much as the mobilization of capital--moving capital from the people who had (and often hoarded) it to those who needed to borrow it for industrial investment.

The problem posed by Postan--the effect of capital immobilities on industrial development--has received considerable attention from economic historians.1 Surprisingly, almost all of the empirical research to date has focused on countries that had, by world standards, fairly well developed capital markets. Little work has been done on the relationship between capital market integration and the degree of industry concentration in economies with truly imperfect capital markets, such as are found in Latin America or Asia. Moreover, because of the absence of data, the studies on developed economies have not developed cross-national estimates of industrial concentration that would allow researchers to measure systematically the impact of access to institutional sources of capital on the structure of industry. Researchers have largely relied on qualitative information or on data from the very recent past (almost all of it of post-1950 vintage) to make cross-

1. Interest among economic historians began with the seminal articles by Lance Davis and Alexander Gerschenkron in the 1960s. See Davis, "Capital Markets"; Davis, "Capital Immobilities"; and Gerschenkron, Economic Backwardness, chap. 1.

ridtional comparisons.[2] These features of the available data (its recent vintage and its focus on economies with well developed capital markets) have made the testing of hypotheses about the long term relationship between the maturation of capital markets and the growth and structure of industry problematic, if not impossible.

This paper proposes to move beyond the literature on the economies of Western Europe and the United States through an historical analysis of the impact of access to impersonal sources of capital on the development of the cotton textile manufacture during the early stages of industrialization (1840-1940) in two less developed economies with different histories of financial market regulation: Brazil, and Mexico. It contrasts their experience with that of the United States during a similar period in its industrial development.

I focus on the cotton textile industry for two reasons. First, the cotton goods manufacture was the most important industry in the underdeveloped economies under study. It surpassed all other industries in terms of capital invested, size of the work force, or percentage of value-added it contributed to total industrial output.[3] Second, there are compelling theoretical reasons to focus on cotton textiles. In underdeveloped economies numerous factors, such as large economies of scale or technological barriers to entry, can condition the development of many industries.

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2. See, for example, Davis, "Capital Markets," p. 271; Pryor, "An International Comparison," p. 136; Adelman, "Monopoly and Concentration," p. 19; Bain, International Differences; Atack, "Firm Size and Industrial Structure," p. 465.

3. As Kuznets pointed out, textiles tend to be the first manufacturing industry to develop as economies modernize. The countries under study here therefore conform to this general pattern. See: Kuznets, Economic Growth of Nations, pp. 111-113.

Separating the effects of access to impersonal sources of capital from among these other factors is difficult across the entire industrial sector. In the cotton textile industry, however, these other factors did not come into play: the capital equipment was easily divisible, the minimum efficient scale of production was small, and non-financial barriers to entry were largely absent. The only important barrier to entry was access to finance. The textile industry therefore provides an excellent test case of the relationship between the development of the financial markets that provide capital to an industry, and the development of the industry itself.[4]

The cases selected for study were chosen in order to test the hypotheses that the regulatory environment has a profound effect on the structure and size of financial markets, and that the structure and size of financial markets has a significant effect on the size and structure of industry. I therefore searched for cases which had notably different histories of financial market regulation.

The United States was chosen because it is the touchstone case: it was an international leader in financial market development and industrial growth during the period under study.[5]

4. This does not mean that scale economies were insignificant in cotton textile production. Indeed, had economies of scale been negligible, access to capital could not have served as a barrier to entry. It does mean, however, that scale economies were exhausted in textiles at relatively small firm sizes compared to such industries as steel, cement, and chemicals.

5. This is not to suggest that problems of capital mobilization did not exist in the United States. The market for industrial securities was regional in nature until the late nineteenth century. Similarly, banks tended not to make loans outside their region. It is to suggest, however, that capital mobilization problems were significantly less severe in the United states than in the underdeveloped world and that the regulation of financial markets was far less repressive in the U.S. case than in

Brazil and Mexico were chosen because they were the most industrialized countries in Latin America. More importantly, these two cases provide a counterfactual test of the hypotheses central to this study. Throughout the nineteenth century, Brazil and Mexico both followed highly repressive regulatory polices. In 1889, however, Brazil drastically changed its financial market regulations to a liberal, relatively non-repressive environment, while Mexico held on to its old repressive policies. Moreover, the costs of obtaining information were lowered in Brazil because its financial market regulations required all publicly held joint stock companies to publish balance sheets and lists of shareholders two times each year. Brazil thus provides a relevant test for understanding the opportunity lost by Mexico when it failed to enact less repressive policies and failed to lower the costs of obtaining information.

The argument advanced runs in the following terms. The size and structure of capital markets played a crucial role in determining the size and structure of the textile industry. In Mexico, where the banking system was small and concentrated, the distribution of bank loans among potential textile industrialists was narrow. Differential access to loans from banks or from the informal network of large, Mexico City merchants, in turn, gave rise to differential access to equity capital: entrepreneurs with the proven ability to obtain loans for working capital had a significant advantage over their competitors when it came to selling equity in the securities markets. In short, a small group

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the underdeveloped world.

of powerful financiers was able to obtain all they capital they needed, while everyone else was starved for funds.

The results were two-fold. First, the textile industry was highly concentrated, because access to impersonal sources of capital served as a barrier to entry. Second, since the ability to mobilize capital from banks and the securities markets was a scarce talent, financial capitalists played an important role in the development of the cotton textile industry.

In countries where the institutional rules of the qame created larger and less concentrated capital markets, such as the United States or post-1889 Brazil, the distribution of funds among potential textile industrilists was broader. Access to institutional sources of finance did not, therefore, serve as a barrier to entry, which in turn meant that the textile industry in those countries tended to be relatively less concentrated. Moreover, in these cases, industry tended to become increasingly less concentrated over time. This was precisely the opposite outcome that obtained in countries where access to institutional sources of capital served as a barrier to entry. In the Mexican case, for example, differential access to capital created by the limited opening of the capital markets during the 1880s and 1890s actually gave rise to an increase in concentration.

The persistence of capital market imperfections in. countries like Mexico or pre-1889 Brazil can basically be tied to two factors. The first was the high costs of information and monitoring. In Mexico, the lax enforcement of reporting requirements made it extraordinarily difficult to obtain

information about the financial state of firms. Investors therefore made investment decisions based on the personal reputations of promotors. This meant that individuals with established reputations had a significant advantage over other potential industrialists in raising capital.

The second factor in limiting the maturation of capital markets were repressive government regulatory policies. These included restrictions on the chartering of joint stock enterprises, complicated provisions for obtaining a bank charter, high minimum capital requirements for banks, and restrictions on bank operations. These repressive policies were enacted to favor small groups of politically well connected financial capitalists by giving their banks special rights and privileges. In return, their banks dedicated a significant part of their portfolio's to government loans, providing a stable and secure source of state finance. Countries like Mexico were able to erect these kinds of barriers to entry into banking because they had very different legal traditions than the United States. In fact, in the case of Mexico, the legal tradition was characterized by the official promotion of monopoly, legal decision by fiat, and the centralization of political power.[6]

The argument developed in this paper runs counter to the dominant view of how financial systems develop. According to that view, financial markets grow up more or less automatically in

6. These characteristics were exactly the opposite of those that prevailed in the United States, where the legal tradition of state's rights and a distrust of monopoly gave rise to a much more open banking structure. For a discussion of the U.S. case see: Smith and Sylla, "The Transformation."

response to the growth in demand for financial services.[7] The argument advanced here holds that the historical development of financial intermediaries is not flexible or automatic. In underdeveloped economies the demand for finance may exceed the growth of institutions designed to mobilize capital for considerable periods of time. Obviously, some capital market development is endogenous, but government policies and the legal tradition have strong independent effects.

The first section of this paper compares the institutional history of financial intermediaries and textile mill financing in the three countries over the period 1840 to 1930.[8] The second section then assesses changes in the size and structure of each country's textile industry in light of their histories of industrial finance.[9] It also develops a cuunter-factual model to estimate the loss to Mexico of its repressive financial market regulatory policies. The third section concludes.

## I. Capital Markets and Textile Finance

### The United States

Unlike the vast majority of American manufacturing companies of the nineteenth century, which were organized as sole proprietorships or partnerships, the large, vertically integrated

7. For a more complete discussion see Patrick, "Financial Development," p. 175.

8. For reasons of space, this discussion is brief. A book length work in progress by the author treats the cases in considerably more detail.

9. Concentration is measured for both Brazil and Mexico by both the four-firm ratio and the Herfindahl Index. In the case of India, it has been possible to estimate Herfindahl indices for only 1900 and 1911; four firm ratios have been estimated for 1900, 1911, 1920, 1930. Work in progress will estimate Herfindahls for all four observations. In the U.S. case concentration is measured solely by the four-firm ratio.

cotton textile producers of New England were organized as publicly-held, joint stock corporations from their very beginnings in the 1820s. The market for these securities was rudimentary during most of the century; the shares of most companies were very closely held, and their often high par values (frequently $1,000) meant they could not be bought by the typical small investor. In addition, these companies appear to have been able to raise capital on a regional scale only; out-of-state shareholders were so scarce as to be virtually nonexistent. Yet these stocks were deemed of investment quality, and their holders knew that a market, however circumscribed, did exist for their sale. As early as 1835, 14 textile issues were traded on the Boston Stock Exchange. This grew to 32 by 1850 and to 40 in 1865. This was not yet a well-developed securities market, but it did provide for a wider distribution of ownership than more traditional forms of business organization would have. Indeed, one of the striking aspects of the large, Massachusetts-type companies was the pattern of widely dispersed ownership of shares among individuals and institutions.[10]

As important as the sale of equity in the capitalization of the early textile mills was the ability of manufacturers, especially small and mid-sized ones, to obtain loans from banks and other institutions. This kind of institutional lending to manufacturers appears to have been confined to the northeast, which quickly developed a large banking system. As early as 1819 New England had 84 banks with a capital of $16.5 million. BY 1860 the

10. Davis, "Stock ownership," pp. 207-14; Martin, A Century of Finance, pp. 126-31; and Navin and Sears, "Rise of a Market," p. 110.

region boasted 505 banks with $123.6 million in capital.[11]

The large number of bank loans to textile manufacturers is not surprising when you consider that the owners of mills tended to be the same people that owned the banks. New England's banks, as Naomi Lamoreaux has shown, were not the independent credit intermediaries of economic theory.[12] Rather, they were the financial arms of kinship groups whose investments spread across a wide number of economic sectors and a wide number of enterprises. Basically, kinship groups tapped the local supply of investable funds by founding a bank and selling its equity to both individual and institutional investors. The founding kinship groups then lent those funds to the various enterprises under their control, including their own textile mills. Insider lending was the rule rather than the exception. Bank resources were therefore monopolized by the families that founded them, leaving little in the way of credit for applicants outside of the kinship group.

Had legal restrictions been placed on the founding of banks, these insider arrangements would have concentrated capital in the hands of a small number of kinship groups, which, in turn would have led to concentration in textile manufacturing. The fact that entry into banking was essentially free, however, meant that it was difficult to restrict entry into the textile industry by controlling access to capital. The U.S. system did not provide for a completely equal distribution of investable funds, but it did allow a large number of players to enter the game.

11. Davis, "New England Textile Mills," pp. 2, 5; Davis, "Sources of Industrial Finance," p. 192; and Lamoreaux, "Banks, Kinship, and Economic Development," p. 651.

12. Lamoreaux, "Banks, Kinship, and Economic Development."

This regionally based capital market was gradually transformed into a national capital market in the- second half of the century, thanks to the passage of the National Banking Act, which created a network of nationally chartered banks, and the widespread sale of government bonds to the public. The practical effects of these institutional developments were far-reaching. In the first place, the number of banks mushroomed throughout the second half of the century. Second, because of a peculiarity of the Civil War banking laws prohibiting nationally chartered banks from making loans on the basis of real estate collateral, national banks in rural areas of the country deposited their funds in the reserve city and central reserve city banks in urban areas. This not only directly increased the supply of funds for industrial loans, but also increased the supply of funds available for stock market speculation. Finally, the public's experience with canal company, railroad, and government securities slowly convinced small investors that paper securities were "as secure an investment as a house, a farm, or a factory."[13] By the end of World War I the textile industry was awash in finance and many companies took advantage of the swollen credit markets to float numerous securities issues.[14]

In short, it was not the case that all American textile industrialists had equal access to impersonal sources of capital. Indeed, one of the primary reasons that the textile industry

13. Davis, "Capital Immobilities," p. 96; and Sylla, American Capital Market, pp. 12, 14, 26, 52, 209.

14. Temporary National Economic Committee, Investigation Of Concentration, p. 255; and Kennedy, Profits and Losses, chaps. 2 and 10.

concentrated for so long in New England was because of inter-regional capital immobilities. But relative to the underdeveloped countries discussed below, large numbers of U.S. industrialists were able to tap into the capital'markets quite early in the country's industrial history.

Mexico

Mexico's experience stands in stark contrast to that of the United States. While Mexico began the transition to a mechanized textile industry as early as the 1830s, it was not until the 1890s that the industry underwent sustained growth. By this point, however, technological changes had raised the cost of entry into textile manufacturing. Thus, unlike U.S. textile manufacturers, who were able to finance a significant part of their expansion and modernization through an extended process of the reinvestment of profits, most Mexican textile firms had to purchase their equipment all at once, increasing the importance of impersonal sources of capital.

The institutions that could mobilize impersonal sources of capital, however, were very poorly developed in Mexico. Even after an expansion of the banking sector and the stock market in the 1880's and 1890s, the vast majority of manufacturers were unable to utilize these avenues to mobilize capital.

Institutional lending to industry was largely absent in Mexico until the 1880s. As late as 1884 there were only eight banks in operation, and as late as 1911 Mexico had but 47 banks, only 10 of which were legally able to lend for terms of more than a year.[15]

15. By 1910 the United States had some 25,000 commercial banks alone. This does not include the thousands of trust companies,

The few banks able to make long-term loans existed primarily to finance urban and rural real estate-transactions; in fact, they had a great deal of difficulty generating their own capital.[16]

Not only were there few banks, but the level of concentration within this small sector was very high. In 1895, three banks--the Banco Nacional de Mexico, the Banco de Londres y Mexico, and the Banco Internacional Hipotecario accounted for two-thirds of the capital invested in the banking system. The first two banks issued 80 percent of the bank notes in circulation. Even as late as 1910 the same two banks dominated the credit market, accounting for 75 percent of the deposits in Mexico's nine largest banks and roughly one-half of all bank notes in circulation.[17] If anything, the years after 1910 saw an increase in concentration, as the Mexican Revolution in that year threw capital markets into disarray, destroyed the public's faith in paper money, and put a brake on the development of the banking sector until the late 1920s.[18]

The result of Mexico's slow and unequal development of credit intermediaries was that most manufacturers could not obtain bank financing. Even those that could only succeeded in getting short-term loans to cover working capital costs. Thus, Mexico's largest bank, the Banco Nacional de Mexico provided credit to a number of large industrial establishments in which its directors had interests. These included five of the nation's largest cotton

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savings banks, and savings and loan associations.

16. Marichal, "El nacimiento, p. 251; Sanchez Martinez, "El sistema monetario," pp. 60, 76-77; Haber, Industry and Underdevelonment, p. 65.

17. Sanchez Martinez, "El sistema monetario," pp. 81-82; and "El Nacimiento," p. 258.

18. Cárdenas and Manns, 1989.

textile producers, its largest wool textile mill, and the two firms that held monopolies on the production of newsprint and explosives. Most of this capital went to a single firm: the Compañía Industrial Manufacturera (CIMSA). But even these insider loans constituted a small part of the total capital of those manufacturing firms. An analysis of the balance sheets of three of the country's largest cotton textile producers during the period from 1907 to 1913 indicates debt-equity ratios averaging .20:1.00. Virtually all of this debt was short term, most of it consisting of trade credits provided by suppliers.19

Equity financing through the creation of a publicly-held, joint stock company was also unknown in the Mexican textile industry until the late 1880's. Even after the first industrial companies appeared on the Mexico City stock exchange, however, the use of the exchange to raise equity capital remained limited. By 1908 only 14 industrials were traded on the exchange: no new firms joined their ranks until the late 1930s. Of those industrial companies only four were cotton manufacturers. Thus, of Mexico's 100 cotton textile firms in 1912 (controlling 148 mills), only four percent represented publicly traded joint stock companies.[20] These four firms, however, took a disproportionate share of total capital invested in the industry, accounting for 27 percent of all active

19. Sánchez Martinez, "El sistema monetario"; Haber, Industry and Underdevelopment, pp. 65-67.

20. The activity of the Mexico City stock exchange was followed by Mexico's major financial weeklies: La Semana Mercantil, 1894-1914; El Economista Mexicano, 1896-1914; Boletín Financiero y Minero, 1916-1938. The behavior of the share; of these firms is analyzed in Haber, Industry and Underdeveloomeht, chap. 7. The total number of firms is from textile manuscript censuses in Archivo General de la Nación, Ramo de Trabajo, caja 5, legajo 4 (also see caja 31, legajo 2).

spindles.

The reason that capital markets were so late in developing in Mexico and then grew in such a limited way was largely owing to three factors. The first of these was the politicized nature of defending property rights and enforcing contracts. Personal ties to members of the government were essential for entrepreneurs to obtain the rights to official monopolies, trade protection, government subsidies, or favorable judicial rulings. Indeed, it was almost impossible to do business without resorting to political machinations.[21] Thus, only well-established financiers with clear ties to the Díaz regime appear to have been successful in floating equity issues. The inclusion of important political actors on the boards of the major joint stock industrial companies (including the brother of the treasury secretary, the minister of war, the president of congress, the undersecretary of the treasury, and even the son of the president) suggests the importance of those ties to the investment community. Further cementing (and demonstrating) those ties was the fact that many of Mexico's most successful financial capitalists not only served on various government commissions and represented the government in international financial markets, but also organized rallies for Porfirio Díaz's [always successful) election campaigns.[22]

The second factor impeding the growth of capital markets was the loose enforcement of financial reporting requirements. In

21. Coatsworth, "Obstacles," p. 98. For a discussion of the politicized nature of the legal system see Walker, Business, Kinship, chaps. 1, 4-5, 7-8.

22. For a discussion of the activities of these entrepreneurs see Haber, Industry and Underdevelonment, chaps. 5, 6.

fact, publicly traded manufacturing companies often failed to publish balance sheets in public documents (such as the Diario Official or the financial press) in many years, even though the law required them to do so. The result was that individuals tended to invest only in those enterprises controlled by important financial capitalists. In this sense, Mexico's major financiers played the same role as individuals like J.P. in the financing of U.S. heavy industry. Their presence on the boards of companies signalled the investment community that a particular enterprise was a safe bet.[23] Two characteristics of the Mexico City stock exchange are particularly striking in this regard. First, almost all of the publicly traded industrials had well known, politically well connected financial capitalists like Antonio Basagoiti, Hugo Scherer, or León Signoret as directors. Second, there was very little entry and exit in the stock exchange. It was not the case that small firms tried to float issues and failed, or that small firms succeeded in selling equity and then went out of business. Rather, the pattern was for a few large firms to be capitalized through the sale of equity. These firms then dominated their respective product lines well into the 1920s and 1930s.[24]

The third factor slowing the development of impersonal sources of finance was Mexico's regulatory environment. Throughout the early and mid-nineteenth century, the lack of modern commercial and incorporation laws retarded the development of banks and joint

23. On the U.S. case see: Davis, "Capital Immobilities"; De Long, "Did J.P. Morgan's Men Add Value?"

24. Examples can be found in the steel, beer, soap, dynamite, cigarette, wool textile, and paper industries, in addition to cotton textiles. See Haber, Industry and Underdevelonment, chaps. 4 ,5.

stock companies. No body of mortgage credit laws was written until 1884, and it was not until 1889 that a general incorporation law was established. Thus, for most of the century it was extremely difficult to enforce loan contracts and establish joint stock companies.

Even when those laws were in place, however, new restrictive banking regulations prevented the widespread development of credit institutions. The Mexican government favored the nation's largest bank, the Banco Nacional de Mexico, with all kinds of special rights and privileges. These included reserve requirements that were half that demanded of other banks, the sole right to serve as the government's intermediary in all its financial transactions, a monopoly for its notes for the payment of taxes or other fees to the government, an exemption from taxes, and the sole right to establish branch banks. At the same time that the government created this privileged, semiofficial institution, it erected significant barriers to entry for competing banks, including extremely high minimum capital requirements (originally 500,000 pesos, later raised to l,OOO,OOO), high reserve requirements (banks were required to hold one-third the value of their bank notes in metallic currency in their vaults and an additional third in the treasury), a prohibition on creating new banks without the authorization of the secretary. of the treasury and the Congress, a prohibition on foreign branch banks from issuing bank notes, a 5 percent tax on the issue of bank notes, and the restriction of bank notes to the region in which the bank operated.[25] Making the

25. When the first minimum was established in 1897, it was equal to $233,973 U.S. The increase in 1908 brought the minimum

situation even more problematic was the revision of these banking laws every few years. The result was a legal environment that was not only restrictive but arbitrary as well.

The motivation behind these restrictive banking policies was essentially twofold. First, the Mexican government was more concerned about establishiny a secure, stable source of finance for itself than it was in creating large numbers of institutions designed to funnel credit to manufacturers. Second, the group of financiers that controlled the Banco Nacional de Mexico also happened to belong to the inner clique of the Díaz regime and had used their political influence to obtain a special concession that restricted market entry.

The tight regulation of banking had two important ramifications. The first was that the number of banks and the extent of their operations remained small: industrial companies could not therefore generally rely on them as a source of finance. The second was that the credit market could not serve as a source of finance for speculation on the stock exchange as it had in the United States (and as it would in Brazil). This served to further impede the growth of the Mexico City stock exchange.

One might think that foreign capital would have made up for the lack of a well developed Mexican capital market. After all, foreign investors were pumping billions of dollars into Mexican oil wells, mines, railroads, utilities, and export agriculture. There

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capital requirement up to $497,265, roughly five times the minimum for nationally chartered banks in the United States. For a discussion of these various privileges and barriers to entry, as well as changes in banking laws, see Sánchez Martinez, "El sistema," pp. 43, 61-62, 67; Ludlow, "La construccion," pp. 334-36; Bátiz V., "Trayectoria de la banca," pp. 286, 287, 293.

was in fact some foreign portfolio investment in Mexico's cotton textile industry, but the phenomenon was not widespread. In any event, to the extent that foreigners invested in the textile industry they invested in the large, well established firms that already had privileged access to the Mexico City stock exchange, thereby reinforcing the problem of differential access to capital. The reason for this lack of foreign investment in textiles was that manufacturing enterprises sold their output domestically, and thus earned their incomes in Mexican silver pesos. Silver, unfortunately, lost 50 percent of its value against gold during the period 1890 to 1902, meaning that the rate of return in foreign, gold-backed currency, was halved once an investor converted his Mexican dividend payments back into sterling, dollars, or francs. In fact, the one foreign company that specialized in Mexican manufacturing investments, the Société Financiere pour l'industrie au Mexique fared very poorly for precisely this reason. Its franc-denominated rates of return were embarrassingly low, and its annual reports read like an apologia to its shareholders for the depreciation of the Mexican peso.[26] It was largely for this reason that foreign investors tended to focus on enterprises in which income was earned in foreign, gold-backed currencies, like oil extraction, mining, and export agriculture, or where the Mexican government offered sizable subidies, like railroading.

In short, throughout its first 100 years of existence, the Mexican cotton textile industry had to rely on informal networks

26. The annual reports of the Société Financière pour l'industrie au Mexique can be found in La Semana Mercantil, 8 Aug. 1903; El Economista Mexicano, 11 Oct. 1902, 6 July 1904, 4 Aug. 1904, 21 Oct. 1905, 18 Aug. 1906.

for its financing. When institutional innovations in the capital market created new opportunities for firms to obtain impersonal sources of finance, only a small group of entrepreneurs was able to benefit.

**Brazil**

Until the last decade of the nineteenth century, Brazilian textile entrepreneurs faced a capital market similar to their Mexican counterparts. Beginning in the 1890's, however, Brazil's capital markets, prompted by government regulatory reforms, underwent a long process of expansion and maturation. The result was that impersonal sources of finance became widely available to Brazilian textile manufacturers.

Throughout most of the nineteenth century, institutions designed to mobilize impersonal sources of capital were largely absent in Brazil. An organized stock exchange had functioned in Rio de Janeiro since early in the century, but it was seldom used to finance industrial companies. During the period from 1850 to 1885 only one manufacturing company was listed on the exchange, and its shares traded hands in only 3 of those 36 years. Neither could Brazil's mill owners appeal to the banking system to provide them with capital. In fact, formal banks were so scarce as to be virtually nonexistent. As late as 1888 Brazil had but 26 banks, whose combined capital totaled only 145,000 cantos--roughly $48 million U.S. Only 7 of the country's 20 states had any banks at all, and half of all deposits were held by a few banks in Rio de Janeiro.[27]

27. Tspik, Political Economy, p. 28; Peláez and Suzigan, Historia monetaria, chaps. 2-5; Saes, 1986: 73; Levy, 1977: 109-12;

The slow development of these institutions can be traced in large part to public policies designed to restrict entry into banking. The imperial government, which held the right to charter banks, was primarily concerned with creating a small number of large super-banks that could serve as a source of government finance and that would prevent financial panics. The absence of banks not only restricted the amount of credit available to textile entrepreneurs, but it also meant that banks could not underwrite securities trading or finance securities speculation, the way they did in the United States and Western Europe.[28] Finally, restrictive policies discouraged the spread of the corporate form of ownership: Founding a joint stock company required special government permission; investors were not allowed to purchase stocks on margin; and banks were restricted from investing in corporate securities.[29]

The last decade of the nineteenth century, however, witnessed a dramatic and sustained transformation of Brazil's capital markets. In the wake of the Revolution of 1889 that deposed the monarchy and established Brazil's First Republic came public policies that deregulated the banking industry and securities markets. These policies had two goals: appease Brazil's slave owning classes for the loss of their slaves in 1888 by increasing the supply of credit; speed Brazil's transition from an agrarian economy run with slave labor to a modern industrial and commercial economy. As of 1889, legal barriers to entry into banking were

28. Stein, 1957: 117; Peláez and Suzigan, 1976: 78-83, 96-97; Saes, 1986: 22, 25-27.
29. Levy, 1887: 52, 209.

removed and banks could engage in whatever kind of financial transactions they wished. Other reforms eased the formation of limited-liability joint stock companies and encouraged securities trading by permitting purchases on margin. Finally, new industrial ventures were exempted from taxes and customs duties.

Also of importance were financial reporting requirements that made managers more accountable to stockholders. Brazil's publicly traded corporations were required to produce financial statements twice a year and reprint them in public documents (such as the Diario Official or the Jornal do Commercio). In addition, their biannual reports had to list the names of all stockholders and the numbers of shares they controlled. Investors could thus obtain reasonably good information on the health of firms and the identities of their major shareholders.[30]

For textile industrialists these reforms produced dramatic results.[31] Over the short term, the Encilhamento, as the invested boom came to be called, created large numbers of banks, which both directly lent funds to manufacturers as well as financed stock market speculation.[32] The second and more important effect of the Encilhamento was that it financed the creation of large numbers of joint stock manufacturing companies. In 1888 only 3 cotton textile enterprises were listed on the Rio stock exchange; by 1894 there were 18, which grew to 25 in 1904 and to 57 in 1915, when it began to level off. Thus, in 1915, 57 of Brazil's 180 cotton textile

30. Sharcholder lists were not published in the abbreviated reports reprinted in the Jornal do Commercio or the Diario Official, but they were published in the original annual reports.

31. Topik, 1987: 28-31; Peláez and Suzigan, 197.6: 143; Stein, 1957: 86.

32. Levy, 1977: 117, 245.

companies (32 percent) were publicly traded, joint stock limited-liability corporations.[33] These firms with access to the equities markets accounted for 43 percent of all invested capital in the industry. Recall that in Mexico only four percent of cotton textile firms were publicly traded, but that these firms took up a relatively more disproportionate share of invested capital (27 percent).

The Encilhamento also created a market for publicly traded corporate debt. This bond market, like the stock exchange, was located in Rio de Janeiro and primarily benefitted Rio and Distrito Federal firms.[34] As early as 1905, 31 of Brazil's 98 textile firms (32%) were raising capital through the sale of debt. By 1915, 50 of the country's 180 firms (28%) reported bond debt in their census returns. In fact, a comparison of the 1905 and 1915 censuses indicates that new debt issues accounted for 32 percent of all new investment during that ten year period (see table one). For the large-scale, Rio de Janeiro and Distrito Federal firms, which were able to easily tap into the bond market, new debt issues accounted for a whopping 63 percent of all new investment from 1905 to 1915 (see table 2). Thus, from 1905 to 1915, the average debt-equity ratio grew from .16:1.00 to .27:1.00 for Brazilian cotton textile firms as a whole and from .15:1.00 to .39:1.00 for firms in the

33. Calculated from: Centro Industrial do Brasil, 1917; Levy, 1977: 245, 385. The peak number of publicly traded textile firms was reached in 1922, when 64 textile issues traded on the Rio exchange. By 1927 this had fallen to 52 firms, as the slow growth of the Brazilian economy in the early 1920s forced out weak firms.

34. During the period under study, Rio de Janeiro was Brazil's capital. The Distrito Federal (Federal District), comprised the area immediately around the city of Rio, much the way that the District of Columbia encloses the city of Washington. Surrounding the Distrito Federal was the state of Rio de Janeiro.

Federal District and Rio de Janeiro.[35] Recall that Mexico's large, publicly traded, vertically integrated firms had debt-equity ratio's roughly half that of their Rio and Distrito Federal counterparts, almost none of which was long term bond debt. In fact, if we were to include the types of trade credits from suppliers and other short term loans that made up the liabilities of Mexican firms (these are not enumerated in the Brazilian censuses), the differences between Brazil and Mexico would be even larger.

The development of the bond market appears to have been slowed by the First World War. Between 1915 and 1924, the nominal value of outstanding long-term debt actually declined. Thus, by 1924 debt-equity ratios fell to .11:1, less than half their 1915 levels. The most important source of new investment capital was retained earnings, which accounted for 62 percent of new additions to capital. The remainder of new capital spending was made up of new equity issues by already established companies and the founding of new firms, particularly in the state of Sao Paulo.[36] In the latter part of the 1920's the debt market began to recover, though it appears that much of the debt issued was used to fund operating losses during the Great Depression. As table one indicates, the increase in debt almost exactly matches the contraction of retained

35. The averages reported are weighted by the size of each firm's total capital investment. These debt-equity ratios do not include short term bank debt or accounts payable, which would have raised the ratios even higher. The censuses did not report these other sources of debt. Estimates of new investment and its sources computed from Vasco, 1905; Centro Industrial, 1917; Centro Industrial 1927.

36. Calculated from Vasco, 1905; Centro Industrial, 1917; Centro Industrial, 1927. All averages are weighted by the value of capital.

earnings during the period 1927 to 1934.

These patterns are mirrored by a micro-level analysis of 15 Rio and D.F. firms that I have traced across the 1905, 1915, 1924, and 1934 censuses (table 2). This study of same-firm financing controls for the possible effects of the entry and exit of firms in the aggregate analysis. In these 13 large scale, publicly traded firms, new debt issues accounted for 63 percent of net new investment between 1905 and 1915. By 1915, 11 of the 13 firms had gone to the bond market (compared to six of the 13 in 1905), producing an average debt-equity ratio of .39:1.00, up from .15:1.00 in 1905. Between 1915 and 1924, however, only two percent of these firms' new additions to capital were financed by new bond debt. Most of their expansion (69 percent) was financed out of retained earnings, while new equity issues accounted for 29 percent of new capital spending. Thus, their average debt-equity ratio fell to .16:1.00 in 1924, less than 60 percent of its 1915 level.[37]

In short, Brazilian textile industrialists were limited in their sources of finance throughout most of the nineteenth century. Beginning in the late 1880s, however, regulatory reforms brought about important innovations in financial intermediation that made access to institutional sources of finance relatively easy for many

37. Calculated from Vasco, 1905; Centro Industrial, 1917; Centro Industrial, 1924; Centro Industrial 1934. All averages are weighted by the value of capital. Rio and Distrito Federal firms were chosen for study because the county's stock and bond markets were located there. The firms are the Companhia Petropolitana, Companhia Magéense, Companhia Manufactora Fluminense, Companhia Corcovado, companhia Brasil Industrial, Companhia Confiança Industrial, Companhia Cometa, Companhia Sao Pedro de Alcantara, Companhia Dona Izabel, Companhia Alliança, Companhia Progreso Industrial do Brasil, Companhia Industrial Campista, and the Companhia America Fabril.

entrepreneurs. Even though the development of these new sources of finance was slowed by the First World War, it still produced an extraordinarily large and well integrated capital market by the standards of developing economies at the time.

## II. Finance and the Structure and Growth of the Textile Industry

What effects did these differences in the development of capital have on the development of the textile industry in the countries under study? One would expect at **least** three. First, Mexico's textile industry should have grown much more slowly than that of Brazil. Second, privileged access to capital should have served as a barrier to entry: capital immobilities should have resulted in high levels of industrial concentration. Industry should have been most concentrated in Mexico and least concentrated in the United States, with Brazil falling between the two. Third, we would expect different trajectories of concentration. Concentration should have fallen the fastest in Brazil, after the opening of its capital markets in the **1890's,** and most slowly in Mexico.

An examination of the data on the development of the textile industry in the three countries bears out these hypotheses. In regard to the rate of growth of the textile industry, the Brazilian textile industry, which had been virtually nonexistent in the first half of nineteenth century, quickly outgrew Mexico's after its capital markets opened up. As late as 1882, the entire modern sector of the Brazilian cotton **goods** industry numbered only 41 firms running just over 70,000 spindles, less than one-third the size of Mexico's cotton goods industry (see Tables 3 and 4). This

relative size relationship continued into the mid-1890s, but over the following ten years widespread access to impersonal sources of capital in Brazil meant that its cotton textile industry was able to outgrow Mexico's by a factor of five, producing for the first time an absolute size difference in favor of Brazil. By the outbreak of World War I, Brazil's industry was roughly twice the size of Mexico's, a gap which grew to three to one by the onset of the Great Depression.

This is not to argue that access to capital was the only factor influencing the rate of growth of the textile industry. There were numerous other constraints to the development of industry.[38] The data suggest, however, that problems of capital mobilization played an important role in the slow development of industry in both countries during the nineteenth century. First, the fact that the textile industries in both Mexico and Brazil underwent a spurt of growth after impersonal sources of finance became available indicates that their lack was a constraint prior to that. Second, the fact that Brazil's textile industry rapidly outgrew Mexican industry after its capital markets opened up suggests an important role for impersonal sources of finance in a country's rate of industrial growth.

one might argue that capital immobilities had little to do with the rate of growth of the textile industry: Demand factors were far more important in influencing industry growth. Mexico's industry was smaller and grew less quickly than that of Brazil

38. For a discussion of these constraints in Mexico see Haber, Industry and Underdevelopment, chaps. 3-5; for a discussion of the Brazilian case see: Stein, Brazilian Cotton Textile Manufacture; Suzigan, Industria Brasileira.

because it had a smaller, poorer population. A comparison of Brazil and Mexico indicates, however, that demand factors cannot explain differences in observed industry size. True, Brazil's population, which was roughly equal to that of Mexico in the early 1870s (9.9 million and 9.1 million, respectively) grew at almost twice Mexico's rate up to 1910 because of Brazil's policy of subsidizing European immigration. Mexican national income, however, outgrew Brazilian national income at a similar rate during this same period. Circa 1877, Mexican national income was only 55 percent that of Brazil. By 1910 it was within six percent of Brazil's. More importantly, Mexican income per capita outgrew that of Brazil by a factor of 10. In 1877, Mexican per capita income was 75 percent that of Brazil. By 1910 Mexican per capita income was 40 percent higher than Brazil's.[39] Given that the income elasticity of demand for textiles was very high, Mexico likely had a much higher per capita demand for textile products than the differences in per capita income would indicate.[40] In short, it is hard to reconcile a demand side story with Brazil's lower absolute levels of per capita income and lower rates of growth of both per capita and national income.[41]

As for the effects of capital immobilities on industrial

39. National income data from Coatsworth, "Obstacles," p. 82. Population data from Instituto Nacional de Estadistica, Geografla, e Informática, Estadisticas, p. 9; Instituto Brasileiro de Geografia e Estatistica, Estatlsticas, p. 33.

40. Contemporary observers noted this high income elasticity of demand for textile products. Their observations can be found in Haber, Industrv and Underdevelopment, pp. 28-29.

41. Accounting for imports would not overturn these results. Both countries were highly protectionist, with tariffs often equal to 300 percent of the value of goods abroad. Imports by 1910 therefore accounted for only 20 of consumption. This was almost entirely high value, fine weave goods.

concentration, the data are unequivocal: access to capital had a significant effect on the level of concentration. Tables 3, 4, and 5 and Graphs 1 and 2 present estimates of four-firm concentration ratios (the percent of the market-controlled by the four largest firms) for all three countries and Herfindahl indices (the sum of the squares of the market shares of all firms in an industry) for Mexico and Brazil.[42] There are a number of striking features of the data.

The first is the low, and continually declining, level of concentration in the United States. As table 5 indicates, the average four-firm ratio during the period 1850-1930 was .089. The trend over time was for concentration to decline at .5 percent per year. From 1860 to 1920, the four-firm ratio dropped from .126 to .066. The Great Depression temporarily reversed the trend, the result of several merger attempts designed to bring the industry's excess capacity under control and end a period of cutthroat competition. Within a few years, however, most of those mergers had failed. Post-1930 evidence indicates that concentration had returned to its 1920 level by 1937.[43] This is precisely the kind of

42. These estimates of concentration are all calculated at the firm level. For the U.S., Mexican, and Brazilian data, this involved combining the market shares of all mills held by a single corporation, partnership, or sole proprietor. Market shares for Mexico and Brazil were calculated from estimates of the actual sales or value of output of mills. Market shares for the United States had to be estimated from information on installed spindles. Econometric work on the United States indicates that there was a 25 percent difference in output per spindle between average and best practice techniques. I therefore assumed that the largest firms in the United States were 25 percent more productive than the average, and adjusted their market shares upwards accordingly. On average and best practice techniques see Davis and Stettler, "The New England Textile Industry," p. 231.

43. Temporary National Economic Committee, Investisation of Concentration, pp. 253-254; Reynolds, "Cut Throat Competition,"

pattern that would be expected in a rapidly growing industry characterized by constant returns to scale technology and insignificant barriers to entry.

The second is that the opening of Mexico's capital markets actually produced an increase in concentration. The trend in Mexico from the 1850s to the late 1880s was a gradual decrease in concentration: exactly the trend that one would expect in an expanding industry characterized by constant returns to scale technology. As Table 4 and Graphs 1 and 2 indicate, Mexico's four-firm ratio fell from a high of .449 in 1850 to a low of .160 in 1878, while the Herfindahl dropped from a .0686 to .0209 over the same period. Beginning in the mid to late 1880s, the trend reversed, even though the industry was witnessing rapid growth. By 1902, both the four-firm ratio and the Herfindahl had nearly regained their 1853 levels, standing at .381 and .0637 respectively. Concentration then began to decrease again to 1912, when the Revolution interceded and again reversed the trend.

The final striking feature of the data is that it indicates that the more profound opening of Brazil's capital markets produced exactly the opposite result than that obtained in Mexico (see Table 3 and Graphs 1 and 2). The sharp drop in concentration from 1866 to 1882 is clearly a mathematical identity, having to do with the small size of the industry in 1866 when there were only nine firms. What is more relevant for our purposes is that this rapid rate of decrease in concentration took off again during the years from '1895 to 1907, and then slowed only slightly to 1914, when it began to

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pp. 740-42; Kennedy, Profits and Losses, chaps. 2-6; Wright, "Cheap Labor," p. 106.

gently level off. By 1914, the estimated Herfindahl index for Brazil stood at less than one-quarter of its 1882 value.[44]

Compared to Mexico, Brazil's textile industry was surprisingly unconcentrated, and became increasingly less so over time. Prior to the 1890s, Brazil's relatively small textile industry displayed higher levels of concentration than Mexico's. By 1905, however, relatively widespread access to institutional sources of capital in Brazil drove concentration down to roughly 60 percent of that in Mexico. Just prior to the onset of the Great Depression, the level of concentration in Brazil was only 58 percent of that in Mexico measured by the four-firm ratio and only 42 percent of that in Mexico measured by the Herfindahl index.

One might argue that Mexico's higher concentration ratios had little to do with capital immobilities: high levels of concentration were produced by demand, not supply factors. Mexico had higher levels of concentration and a different trajectory of concentration because it had a smaller textile industry than Brazil or the United States. There are four problems with this line of argument.

The first is that this argument assumes that there is a direct link between industry size and industry structure: the larger a country's industry, the less concentrated it should be. In order to test this notion, I estimated four firm concentration ratios for the Indian cotton textile industry. Since India's industry was

44. One might argue that these differences in concentration would disappear if imports of foreign textiles were accounted for, but that argument does not stand up to the empirical evidence on textile imports. Indeed, both Brazil and Mexico followed highly protectionist policies after 1890, virtually eliminating imported cloth except for fine weave, high value goods.

roughly three times the size of Brazil's we should observe a lower level of concentration there. In fact, India's average level of concentration during the first three decades of the twentieth century was very close to that of- Brazil, and during the 1920's exceeded Brazilian concentration (see table 6 and graph 1).

The second is that Mexico's industry leaders were tremendous operations in an absolute sense. Mexico's leading firms were not simply large relative to the small Mexican market, they were enormous operations, even by U.S. and Indian standards- Mexico's largest firm in 1912, for example, the Compañía Industrial de Orizaba (CIDOSA), was a four-mill operation employing 4,284 workers running 92,708 spindles and 3,899 looms. Had it been located in the United States, it would have ranked among the 25 largest cotton textile enterprises. Had it been located in India it would have been among the top 12 textile enterprises. Significantly, in the country with the market size closest to that of Mexico, Brazil, the largest firm was actually smaller than CIDOSA. Brazil's largest producer, the Companhia America Fabril, controlled 6 mills in 1915, employing 3,100 workers running 85,286 spindles and 2,170 looms.

The third problem with this argument is that it does not stand up to empirical evidence on the relationship between total factor productivity (TFP) and firm size. In graphs 3, 4, 5, and 6 I present estimates of TFP by firm size for Mexico in 1896 and 1912. All four specifications indicate that the minimum efficient scale of production in Mexico was reached at surprisingly small firm sizes. No specification of firm level factor productivity indicated that the industry leaders had a productivity advantage over their

competitors (see graphs 3, 4, 5, 6).

The fourth problem with this hypothesis is that it cannot explain why Mexican concentration increased during a period when the industry was experiencing rapid growth, the years 1878-1902. Without some supply factor intervening during this period, Mexican concentration should have continued to decline, instead of jumping back up to its 1850 level.

In order to test this hypothesis in a formal manner, I estimated a simple OLS regression that measures the elasticity Of concentration with respect to industry size. The logic behind the estimation is the following: in an industry characterized by modest returns to scale, with no significant technological changes that would raise the minimum efficient scale of production in a discontinuous way, we should be able to predict the level of concentration simply by knowing the size of the industry. Similar regression results for Brazil and Mexico would indicate that concentration was simply a function of industry size. If, however, similar specifications of the regression for each country yield different results, then some intervening variable (like an imperfection in a factor market) must have been at work.[45]

45. The model makes the reasonable assumption that there were no discontinuous jumps in minimum efficient scales in either country, though it does allow for a gradual increase in minimum efficient'scales. For this reason, it is unlikely that the elasticities of the size variables will sum to unity. Observations by contemporaries indicate that there were no discontinuous jumps in textile manufacturing technology during the period that affected the Brazilian or Mexican industries. The only major innovation was the Northrup automatic loom, which was developed in the 1890s. But the Northrup loom was not widely. adopted in either country (there were only 25 of them in service in Mexico as late as 1910). Moreover, to the extent that there were technological jumps, these would be more pronounced in the Brazilian regressions than in those for Mexico, because of Brazil's faster purchase of new capacity.

Table 7 presents various regression specifications. All values are converted to natural logs in order to capture how changes in the size of the industry effect the change in concentration. Concentration is measured as the Herfindahl Index.

The first specification of the regression measures industry size as simply the number of active firms. For Brazil we obtain fairly unambiguous results: the parameter estimate for (ln)firms is -.72 with an $R^2$ of .98. That is, the elasticity of concentration with respect to size is .72 (as industry size doubles concentration decreases by 72 percent). Ninety eight percent of the movement in concentration is explained by change in industry size. For Mexico, however, the results are much less robust: the parameter estimate for (ln)firms is significantly lower (-.44) and the $R^2$ is only .17. In short, the results indicate that in Brazil we can predict concentration from industry size with a great deal of certainty, but in Mexico we cannot (see Table 7).

Perhaps it is the case that the number of firms is a poor proxy for industry size. The second specification of the regressions therefore substitutes the natural log of the number of active spindles as the independent variable. This specification again yields robust results for Brazil, but again fails to serve as a meaningful predictor of concentration in Mexico. For Brazil the parameter estimate on (ln)spindles is -.42 with an $R^2$ of .95. For Mexico, the parameter estimate is only -.09 and $R^2$ is only .04, indicating no correlation between the two variables.

The third specification of the regression assumes that

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This would tend to bias the results against the hypothesis advanced here.

spindles and firms are not collinear and includes both size measures on the right hand side of the equation. For Brazil we again get an extraordinarily good fit. The parameter estimate is -.07 for (ln)spindles and -.60 for (ln)firms. $R^2$ is .98. Since the combined elasticities are actually lower than for (ln)firms alone, it appears that firms and spindles are collinear. This makes perfect sense in an industry characterized by modest returns to scale and low barriers to entry. As the industry grows, the number of firms does as well.

The Mexican results, however, again indicate that concentration cannot be explained by industry size. While the third specification of the regression yields a high parameter estimate of -1.28 for (ln)firms, the parameter estimate for (ln)spindles points the wrong way (.50). Most of the variance around the mean cannot be explained by the regression: $R^2$ is only .38, though it is significant that $R^2$ more than doubles if both variables are included. What is particularly striking is that this specification indicates that (ln)spindles and (ln)firms were not collinear in Mexico, as they were in Brazil, suggesting that in Mexico an industry that a priori should be characterized by modest or constant returns to scale was behaving like an industry characterized by sizable increasing returns to scale.

In short, all three specifications of the regressions indicate that concentration in Brazil was a function of industry size, but in Mexico it was not. A glance at Tables 3 and 4 and Graphs 1 and 2 quickly indicate why it was not: in many years in post-1890 Mexico concentration actually increased as industry size grew.

Some other intervening variable influenced concentration in Mexico. What would Mexican industry have looked like, in terms of its structure, had this other intervening variable not been operating? Assuming that in the absence of this intervening variable the same relationship between industry size and industry structure would have held for both Brazil and Mexico, estimating Mexico's predicted level of concentration is a straightforward operation. It simply entails estimating a predicted Herfindahl series using the Brazilian coefficients from the first specification of the regression (see Table 7) and the actual Mexican data on numbers of firms and spindles.[46]

Table 8 and Graph 7 present these predicted Herfindahl values for Mexico, as well as the actual Mexican and Brazilian series. There are two features about the predicted series that are notable. The first is that until the early 1890's the fitted series does a reasonably good job of predicting the movement of concentration in Mexico, indicating that the statistical relationship between industry size and concentration observed in Brazil held in Mexico as well until its capital markets opened up. The second is that after 1893 Mexico's actual and predicted Herfindahl values moved in entirely different directions. By 1902, the actual level of concentration in Mexico was more than twice its predicted value.

What mechanisms were at work causing Mexico's level of

46. This is an upper bound prediction. The model assumes that Mexico's industry size would have been the same in the presence of a better developed capital market, which is highly unlikely. Had the size of the industry been larger, the predicted concentration ratios would be even lower than those estimated here. The first specification of the regression was used because it provided the best fit for both the Mexican and Brazilian data.

industrial concentration to increase during a period of rapid expansion? Why did the trajectory of concentration in Mexico reverse in the 1890's, and why did it resume its fall after 1902?

The answer to these questions basically turns on the effects of the limited opening of Mexico's capital markets. In the years after 1889 Mexico's big, multi-plant, industry leaders (the CompaAia Industrial de Orizaba, CompaAia Industrial Veracruzana, Compañía Industrial de Atlixco, and CompaAia Industrial de San Antonio Abad) were founded with capital provided by the Mexico City stock exchange. These firms were able to purchase newer, more efficient equipment faster than their smaller competitors who did not have recourse to the sale of equity. The result was increasing levels of concentration.

why then did concentration drop in the years from 1902 to 1912? Why did the industry leaders not continue to exercise market dominance? The answer is that after they achieved control of the market, Mexico's industry leaders dramatically slowed their rate of new investment. A comparison of the 1895 and 1912 cross sections indicates that firms that had access to the capital market did not purchase new machinery at a faster rate than did non-capital market firms. In fact, a comparison of firms extant in both censuses indicates that, if anything, firms that did not have access to impersonal sources of capital purchased new machinery at a faster rate than firms that had access to the capital market. Under a set of assumptions that minimizes the replacement of old equipment by new equipment (thereby biasing downward the total addition of new machinery), the non-capital market firms purchased new looms at a

rate roughly equal to that of the capital market firms and purchased new spindles at a rate more than 50 percent faster. Under a set of assumptions that maximizes the replacement of old machinery by new machinery (thereby biasing upwards the total addition of new machinery), the non-capital market firms purchased new looms at a 13 percent faster rate than capital market firms and new spindles at a 35 percent faster rate.

total factor productivity differentials in the 1895 and 19.12 census

In short, the data suggest that the handful of firms that were able to mobilize capital through institutional sources gained a one-time advantage over their competitors. They then sat back and watched their rents dissipate as their smaller competitors gradually closed the size gap through the reinvestment of retained earnings. Why they pursued this strategy is somewhat of a mystery at this point. It may have been that their managers perceived (incorrectly) that their ability to mobilize institutional sources of capital would have served as a disincentive to new entrants. Potential new entrants would, according to this rationale, have seen that the industry leaders could rapidly install excess capacity, thereby increasing production and lowering prices below the potential entrant's long run average cost curve. Or it may have been that stockholders did not trust the management of the enterprises or were operating with a short time horizon. They therefore demanded that all profits be paid out as dividends. It might also have been that the rates of return available from the big, multi-plant mills were disappointing to the investment community. New infusions of equity capital may therefore have

dried up after 1902. Evidence from the Mexican financial press lends considerable support to this interpretation. Of the four firms that were able to raise capital through the securities markets (CIDOSA, CIVSA, CIASA, and San Antonio Abad), two paid dividends on an extremely irregular basis. One of them, San Antonio Abad, failed to pay anything from 1899 to 1906. When it resumed paying in 1906 and 1907 the real value of its dividends per share were less than 20 percent of the average dividend per share prior to 1899. Though the two industry leaders, CIDOSA and CIVSA paid steady dividends, the real value of CIDOSA's dividends fell by two-thirds after 1900 and stayed at this lower level for the rest of the decade.[47] Work in progress hopes to shed additional light on this issue.

Whatever the source of this peculiar behavior by the industry leaders, the lack of new investment on their part, coupled with the relatively slow rate of growth of new investment implied by the need to finance new plant and equipment purchases out of retained earnings by their competitors, suggests that the overall rate of growth of productivity in Mexico must have been low relative to Brazil and the United States.

## III. Conclusions

What lessons are there to be drawn from this story about government regulation, capital market development, and the growth and structure of industry?

The first is that government regulatory policies had a significant effect on the growth of capital markets. Capital

47 Haber, Industry and Underdevelopment, p. 115.

market development in the three countries studied here was not completely endogenous to the process of economic growth: different histories of government regulation in each of the cases gave rise to very different sizes and structures of capital markets.

Second, capital immobilities appear to have been in large part the product of the inability of investors to obtain information and monitor managers. In Mexico, information was difficult to obtain. This gave well known financiers with established reputations privileged access to the capital markets. This was a very different outcome than that which obtained in Brazil, where the costs of information appear to have been much lower.

Third, differences in capital market development had a significant impact on the rate of growth of industry. Mexico's financial system, in which a small group of entrepreneurs could get access to impersonal sources of capital while most entrepreneurs could not, gave rise to a small textile industry relative to Brazil. The rapid expansion of the Brazilian textile industry after the opening up of the capital markets in the late 1880's underlines the important role played by access to finance in industrial growth. In sum, lack of access to institutional sources of capital because of poorly developed capital markets was a non-negligible obstacle to industrial development in the nineteenth century.

Fourth, imperfections in capital markets also had a significant effect on the structure of industry. The much more limited opening of the capital markets in Mexico gave rise to higher levels of concentration than in Brazil and the United States. Analysis of the data indicates that these differences

existed independent of industry size.

Fifth, the data analyzed to date suggest that Mexico's peculiarly uncompetitive structure of industry may have created disincentives to new investment by its industry leaders. In addition, the need to rely on retained earnings to finance most new investment would suggest that in general Mexico's rate of growth of investment was much slower than in countries that had more open capital markets. The result may well have been much slower rates of growth of output and productivity in the Mexican case, meaning that Mexican industry may have become increasingly less competitive over time. Work in progress hopes to shed light on this issue.

TABLE ONE

Capital Structure af the Brazilian Textile Industry
(1882-1934)
(Millions of Current Milreis)

Panel I

| Year | 1 Paid in Capital* | 2 Retained Earnings | 3 (1+2) Equity | 4 Debt Issues | 5 (3+4) Total Capital |
|---|---|---|---|---|---|
| 1882 | | | | | 7.3 |
| 1895 | | | | | 47.4 |
| 1905 | | | 177.1 | 28.3 | 205.4 |
| 1907 | | | | | 214.6 |
| 1914 | | | | | 314.1 |
| 1915 | | 39.5 | | | 350.4 |
| | 236.4 | 272.5 | 375.9 | 34.5 | 726.3 |
| 1924 | 462.0 | 349.7 | 811.7 | 99.6 | 911.3 |
| 1925 | 557.7 | 321.1 | 940.7 | 147.3 | 1,088.0 |
| 1926 | 606.8 | 292.0 | 1,017.9. | 134.8 | 1,152.8 |
| 1927 | 659.2 | | 951.2 | 245.4 | 1,196.6 |
| 1934 | | | | | |

* Includes declared value of partnerships and sole proprietorships.

Panel II

| Year | 6 (1/5) Paid/ Total Cap. | 7 (4/5) Debt/ Total Cap. | 8 (2/5) Retained/ Total Capital | 9 (3/5) Total Equity/ Capital | 10 (4/3) Debt Equity Ratio | 11 New Debt as % Total New Capital | 12 Annual Change Debt/ Ann. Change Total Cap. |
|---|---|---|---|---|---|---|---|
| 1882 | | | | | | | |
| 1895 | | | | | | | |
| 1905 | | 0.14 | | 0.86 | 0.16 | | |
| 1907 | | | | | | | |
| 1914 | | | | | | | |
| 1915 | 0.67 | 0.21 | 0.11 | 0.79 | 0.27 | 0.319 | 0.032 |
| 1924 | 0.53 | 0.10 | 0.38 | 0.90 | 0.11 | -0.012 | -0.001 |
| 1925 | 0.51 | 0.11 | 0.38 | 0.89 | 0.12 | 0.161 | 0.161 |
| 1926 | 0.51 | 0.14 | 0.35 | 0.86 | 0.16 | 0.270 | 0.270 |
| 1927 | 0.53 | 0.12 | 0.36 | 0.88 | 0.13 | -0.192 | -0.192 |
| 1934 | 0.55 | 0.21 | 0.24 | 0.79 | 0.26 | 2.524 | 0.361 |

Table Two

Capital Structure of Selected Riu de Janeiro and Distrito Federal Firms (1905-1934)
(Millions current Milreis

Panel 1

| Year | 1 Paid In Capital | 2 Reserve | 3 Equity | 4 Bonds | 5 Total Capital |
|---|---|---|---|---|---|
| 1905 | | | 67.4 | 9.9 | 77.3 |
| 1915 | 63.7 | 16.4 | 80:0 | 31.2 | 111.2 |
| 1924 | 101.1 | 103.2 | 204.3 | 33.4 | 237.7 |
| 1934 | 110.3 | 87.9 | 198.2 | 58.8 | 257.0 |

Panel 2

| Year | 6 (3/5) Debt/ Total | 7 2/5) 6eserves/ Total | 8 (3/5) Equity/ Total | 9 (4/3) Debt Equity Ratio | 10 New Debt as % Total New Capital | 11 New Reserves as a Total New Capital |
|---|---|---|---|---|---|---|
| 1905 | 12.8% | | 87.2% | 14.6% | | |
| 1915 | 28.0% | 14.7% | 72.0% | 39.0% | 62.9% | |
| 1924 | 14.1% | 43.4% | 85.9% | 16.4% | 1.8% | 68.6% |
| 1934 | 22.9% | 34.2% | 77.1% | 29.7% | 131.4% | -78.6% |

Table Three

Size and Structure of the Brazilian Cotton Textile Industry

| Year | Active Firms | Firms With Useful Data | Active Spindles | Four Firm Ratio* | Herfindahl Index* |
|---|---|---|---|---|---|
| 1866 | 9 | 9 | 14,875 | .766 | .1773 |
| 1882 | 41 | 30 | 70,188 | .376 | .0631 |
| 1883 | 44 | 33 | 65,937 | .371 | .0582 |
| 1895 | 43 | 27 | 169,451 | ,349 | .0585 |
| 1905 | 98 | 80 | 734,928 | .207 | .0279 |
| 1907 | 117 | 115 | | ,203 | .0250 |
| 1914 | 227 | 210 | | .143 | .0144 |
| 1915 | 180 | 168 | 1,492,822 | .161 | .0165 |
| 1924 | 202 | 162 | 2,161,080 | .212 | .0222 |
| 1925 | 226 | 186 | 2,469,247 | .179 | .0182 |
| 1926 | 272 | 213 | 2,504,339 | .166 | .0155 |
| 1927 | 273 | 231 | 2,634,293 | .162 | .0141 |
| 1934 | 266 | 247 | 2,700,228 | .173 | .0168 |

* Concentration measured at the firm level. See footnote 59.

Source: Borja Castro, "Relatorio do Segundo grupo," pp. 3-73; Commissao de Inquerito Industrial, Relatorio ao Ministerio da Fazenda, Ministerio da Indústria, Viaçao e Obras Publicas, Relatorio, 1896; Vasco, "A industria do algodao"; Centro Industrial do Brasil, O Brasil; Centro Industrial do Brasil, O Centro Industrial; Centro Industrial de Fiacao e Tecelagem de Algodao, Estatísticas da indbstria; and Stein, Brazilian Cotton Textile Manufacture, appendix 1.

Table Four

Size and Structure of the Mexican Cotton Textile Industry, 1843-1929

| Year | Firms Listed | Firms With Useful Data | Active' Spindles | Four Firm Ratio* | Mexico Herfindahl Index* |
|---|---|---|---|---|---|
| 1843 | 52 | 51 | 95,208 | 0.376 | 0.0524 |
| 1850 | 51 | 51 | 135,538 | 0.449 | 0.0686 |
| 1853 | 36 | 36 | 121,714 | 0.430 | 0.0677 |
| 1862 | 40 | 40 | 129,991 | 0.319 | 0.0490 |
| 1865 | 52 | 52 | 151,722 | 0.342 | 0.0501 |
| 1878 | 81 | 81 | 249,294 | 0.160 | 0.0209 |
| 1883 | 83 | 83 | | 0.189 | 0.0225 |
| 1888 | 110 | 91 | 249,561 | 0.217 | 0.0249 |
| **1091** | 80 | **78** | | 0.228 | 0.0268 |
| 1893 | 89 | 83 | 351,568 | 0.284 | 0.0355 |
| 1895 | 85 | 85 | 411,090 | 0.363 | 0.0480 |
| 1896 | 97 | 83 | 397,767 | 0.371 | 0.0513 |
| 1902 | 109 | 109 | 595,728 | 0.381 | 0.0637 |
| 1906 | 106 | 106 | 688,217 | 0.338 | 0.0486 |
| 1912 | 100 | 100 | 749,949 | 0.271 | 0.0343 |
| 1919 | 88 | 88 | 735,308 | 0.374 | 0.0592 |
| 1929 | 123 | 123 | 839,109 | 0.278 | 0 . 0 3 3 5 |

* Concentration measured at the firm level. See footnote 59.

Sources: Secretaria de Hacienda y **Crédito Público,** Documentos, p. 81; Ministerio de Fomento, Estadistica del Departamento, table 2; Ministerio de Fomento, Memoria (1857), **docs.** 18-1, 18-2; **Dirección** de **Colonización** e Industria, Memoria (1850); **Pérez** Hernbndez, Estadistica; Ministerio de Fomento, Memoria (1865), pp. 438-40; Secretaria de Fomento, **Boletin** Semestral de la **República** Mexicana, 1889; Secretaria de Fomento, Anuario Estadistico de la **República** Mexicana, 1893; Secretaria de Fomento, Anuario Estadistico de la **República** Mexicana, 1895; Secretaria de Hacienda, Memoria, 1895; **Archivo** General de la **Nación,** Ramo de Trabajo, **caja** 5, legajo 4; Secretaria de Hacienda, **Boletín,** second semester 1919, first semester 1920, Jan. 1930; La Semana **Mercantil,** June 23, 1902 and **June 25, 1906;** Haber, Industry and Underdevelonment, pp. 125, 158.

**Table Five**

**Size** and Structure of the U.S. Cotton Textile Industry

| Year | Active Mills | Spindles | Four Firm Ratio* |
|---|---|---|---|
| 1850 | 1,094 | | . 100 |
| 1860 | 1,091 | | . 126 |
| 1870 | 956 | | .107 |
| 1880 | 756 | 10,653,435 | . 087 |
| 1890 | 905 | 14,384,180 | .077 |
| 1900 | 1,055 | 19,463,984 | .070 |
| 1910 | 1,324 | 28,178,862 | . 075 |
| 1920 | 1,496 | 34,603,471 | .066 |
| 1930 | 1,281 | 33,009,323 | . 095 |

* Concentration measured 'at the firm level. See footnote 59.

Sources: Calculated from U.S. Bureau of the Census, Census of Manufactures, 1849-1929; Bateman and Weiss Large Firm Sample for 1840-1860; Davison's Blue Book; Official American Textile Directory; The Textile Manufacturer's Directory; and Dockham's American Report.

Table Six

Size and Structure of the Indian Cotton Textile Industry

| Year | Mills | Spindles | Four Firm Ratio* | Herfindahl Index* |
|---|---|---|---|---|
| 1865 | 13 | 285,524 | | |
| 1875 | 36 | 886,098 | | |
| 1885 | 87 | 2,145,646 | | |
| 1900 | 193 | 4,945,783 | .190 | .0178 |
| 1911 | 261 | 6,357,460 | .190 | .0181 |
| 1920 | 253 | 6,763,036 | .206 | |
| 1930 | 348 | 9,124,768 | .189 | |

* Concentration measured at the firm level. See footnote 59.

Source: Estimated from Report of the Bombay MillownersAssociation, 1900, 1911, 1920. 1930.

Table Seven

Alternate Specifications of Industrial Concentration Regressions

Mexico (1843-1929) and Brazil (1866-1934)

Dependent Variable: (ln)Herfindahl Index
T statistics in parentheses

| | Mexico | | | Brazil | | |
|---|---|---|---|---|---|---|
| | Spec. 1 | Spec. 2 | Spec. 3 | Spec.1 | Spec. 2 | Spec.3 |
| Intercept | -1.28 | -1.92 | -3.83 | -.31 | 2.09 | -.08 |
| (ln)firms | -.44 (-1.73) | | -1.29 (-2.58) | -.72 (-22.66) | | -.60 (-3.12) |
| (ln)spindles | | -.09 (-0.74) | .50 (1.97) | | -.42 (-13.80) | -.07 (-.59) |
| $R^2$ | .17 | .04 | .38 | .98 | .95 | .98 |
| N | 17 | 15 | 15 | 13 | 11 | 11 |

Source: See tables 3 and 4.

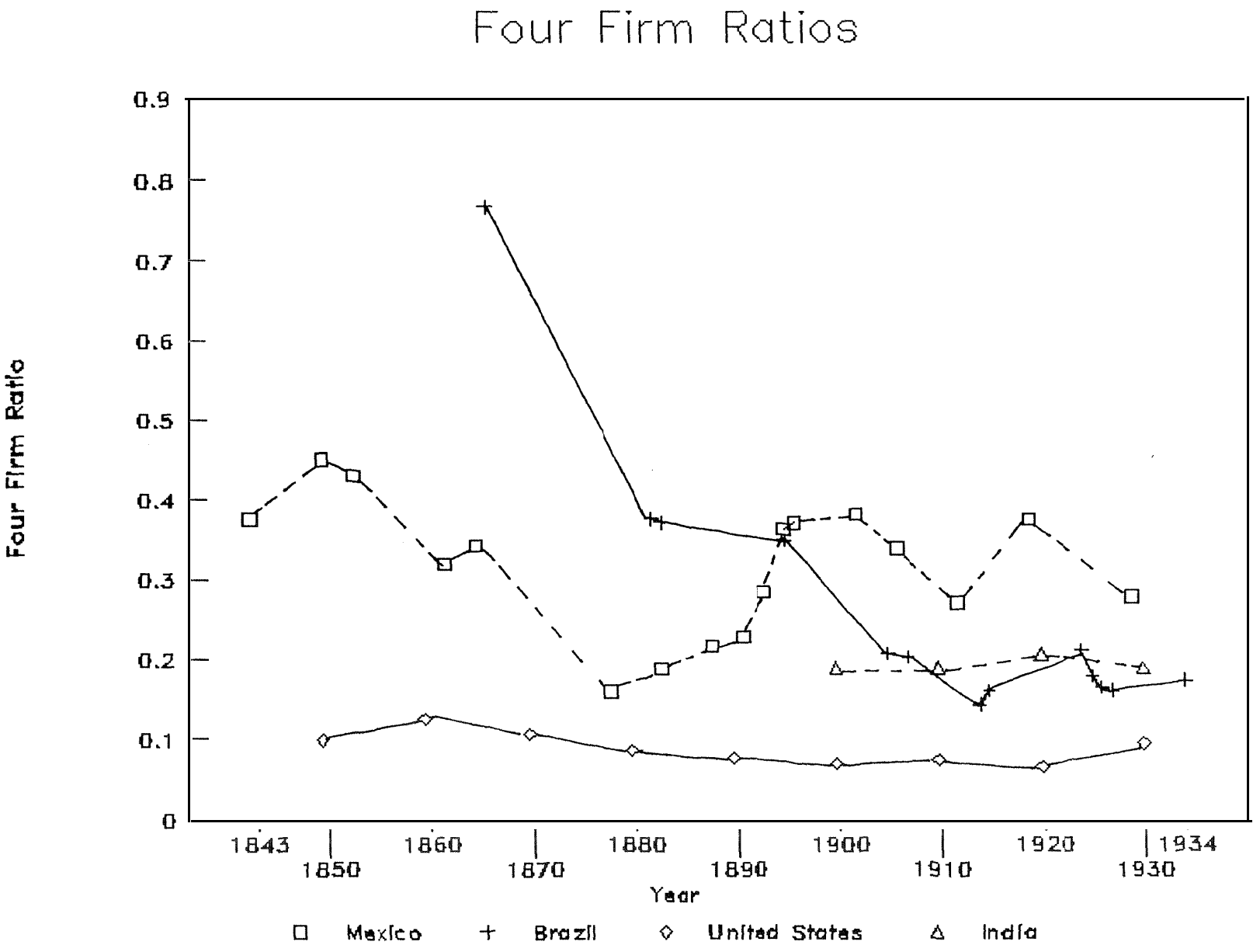
Table Eight

Actual and Predicted Herfindahl Indices,
Mexico and Brazil 1843-1934

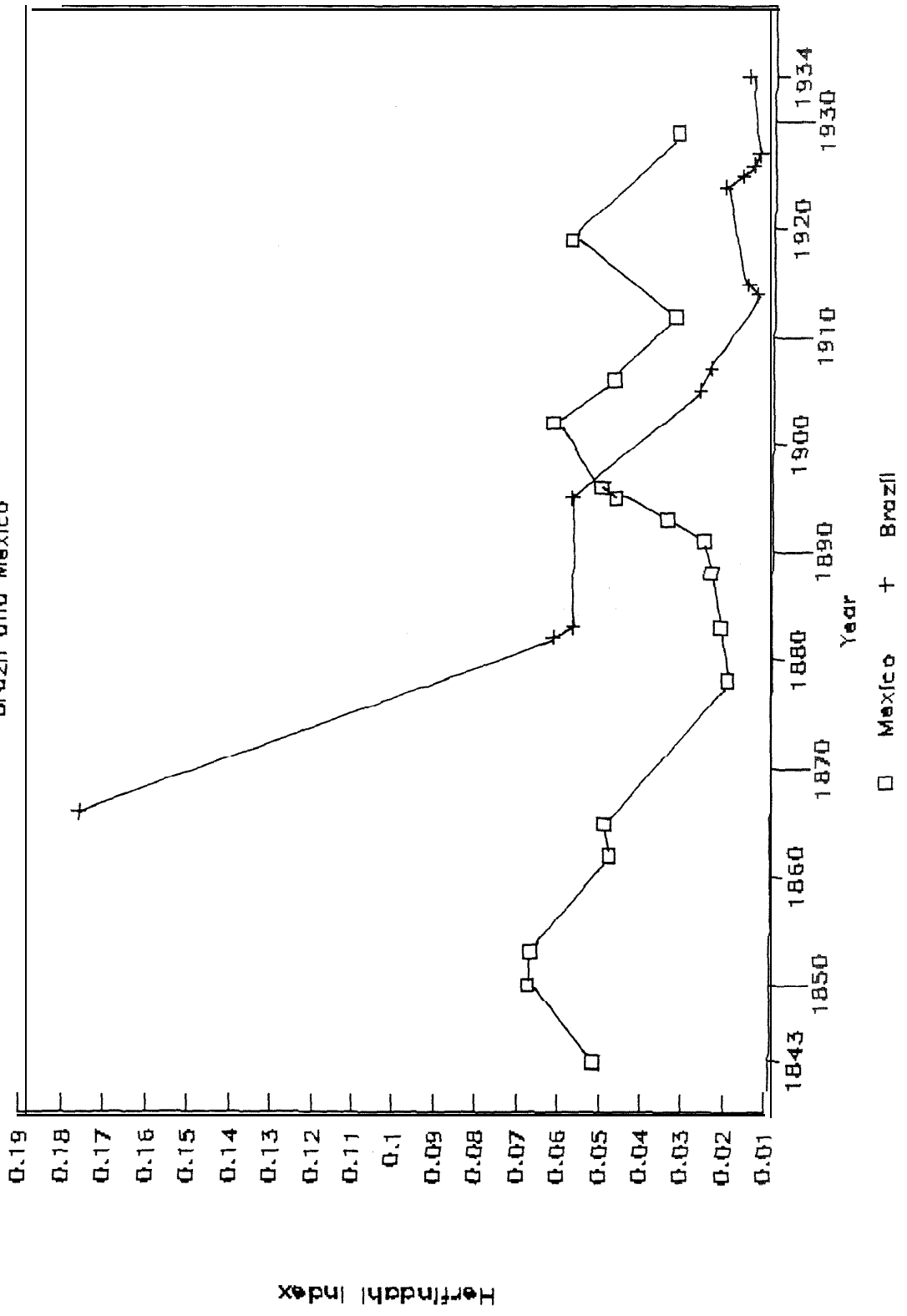
| | ACTUAL MEXICO | PREDICTED MEXICO | ACTUAL BRAZIL |
|---|---|---|---|
| 1843 | .0524 | .0432 | |
| 1850 | .0686 | .0432 | |
| 1853 | .0677 | .0556 | |
| 1862 | .0490 | .0515 | |
| 1865 | .0501 | .0426 | |
| 1866 | | | .1773 |
| 1878 | .0209 | .0310 | |
| 1882 | | | .0631 |
| 1883 | .0225 | .0305 | .0582 |
| 1888 | .0249 | .0285 | |
| 1891 | .0268 | .0318 | |
| 1893 | .0355 | .0305 | |
| 1895 | .0480 | .0299 | .0585 |
| 1896 | .0513 | .0305 | |
| 1902 | .0637 | .0250 | |
| 1905 | | | .0279 |
| 1906 | .0486 | .0255 | |
| 1907 | | | .0250 |
| 1912 | .0343 | .0266 | |
| 1914 | | | .0144 |
| 1915 | | | .0165 |
| 1919 | .0592 | .0292 | |
| 1924 | | | .0222 |
| 1925 | | | .0182 |
| 1926 | | | .0155 |
| 1927 | | | .0141 |
| 1929 | .0335 | .0229 | |
| 1934 | | | .0168 |

SOURCE: Actual data from tables 3 and 4. Predicted Mexico series uses the parameter estimates for Brazil from specification one in table 7 and the actual Mexican data on number of firms with useful data. It predicts Mexico's level of concentration had the same relationship held between industry size and industry structure as in Brazil.

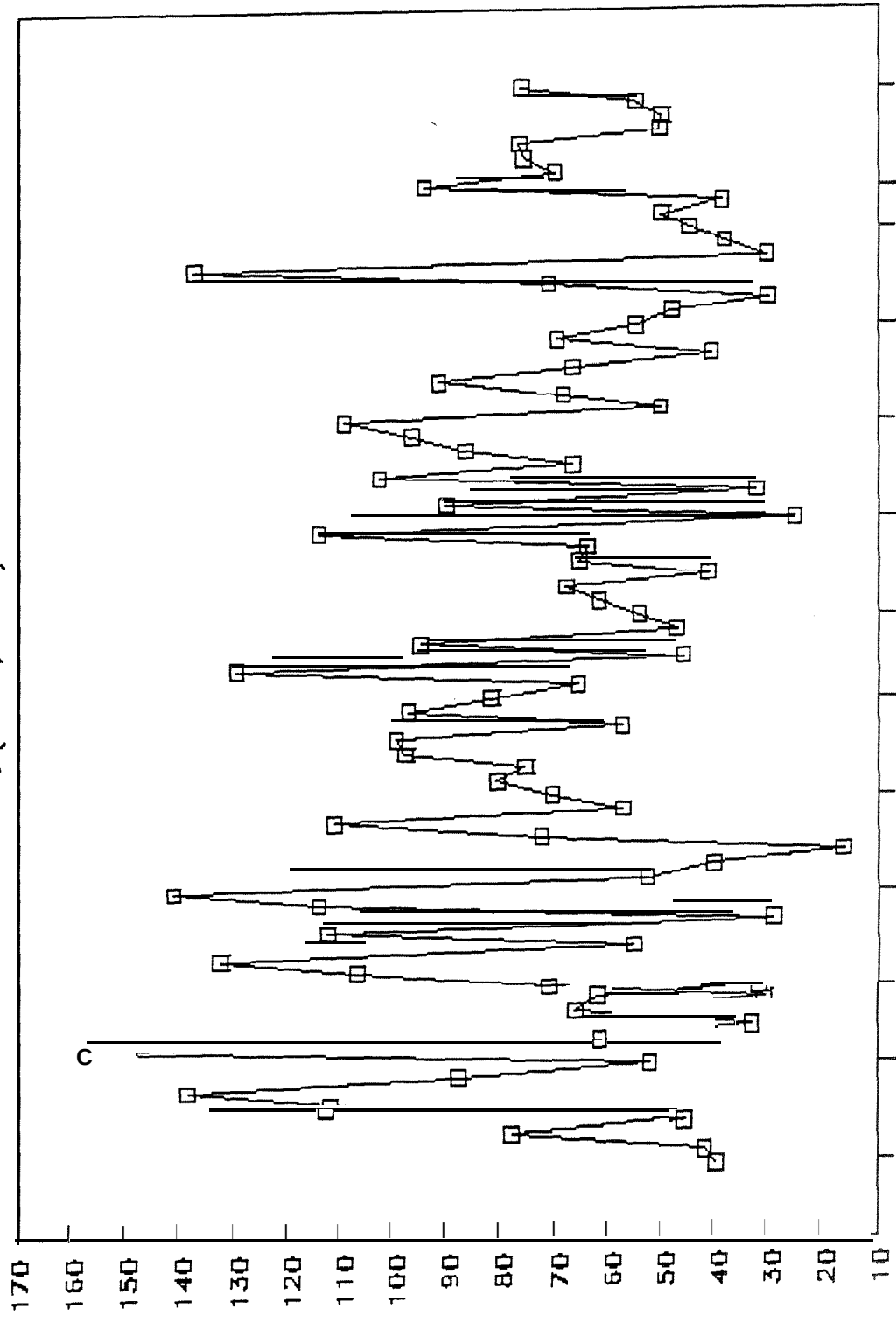
GRAPH ONE


Four Firm Ratios
Four Firm Ratio
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1843
1850
1860
1870
1880
1890
1900
1910
1920
1930
1934
Year
Mexico
Brazil
United States
India

GRAPH TWO

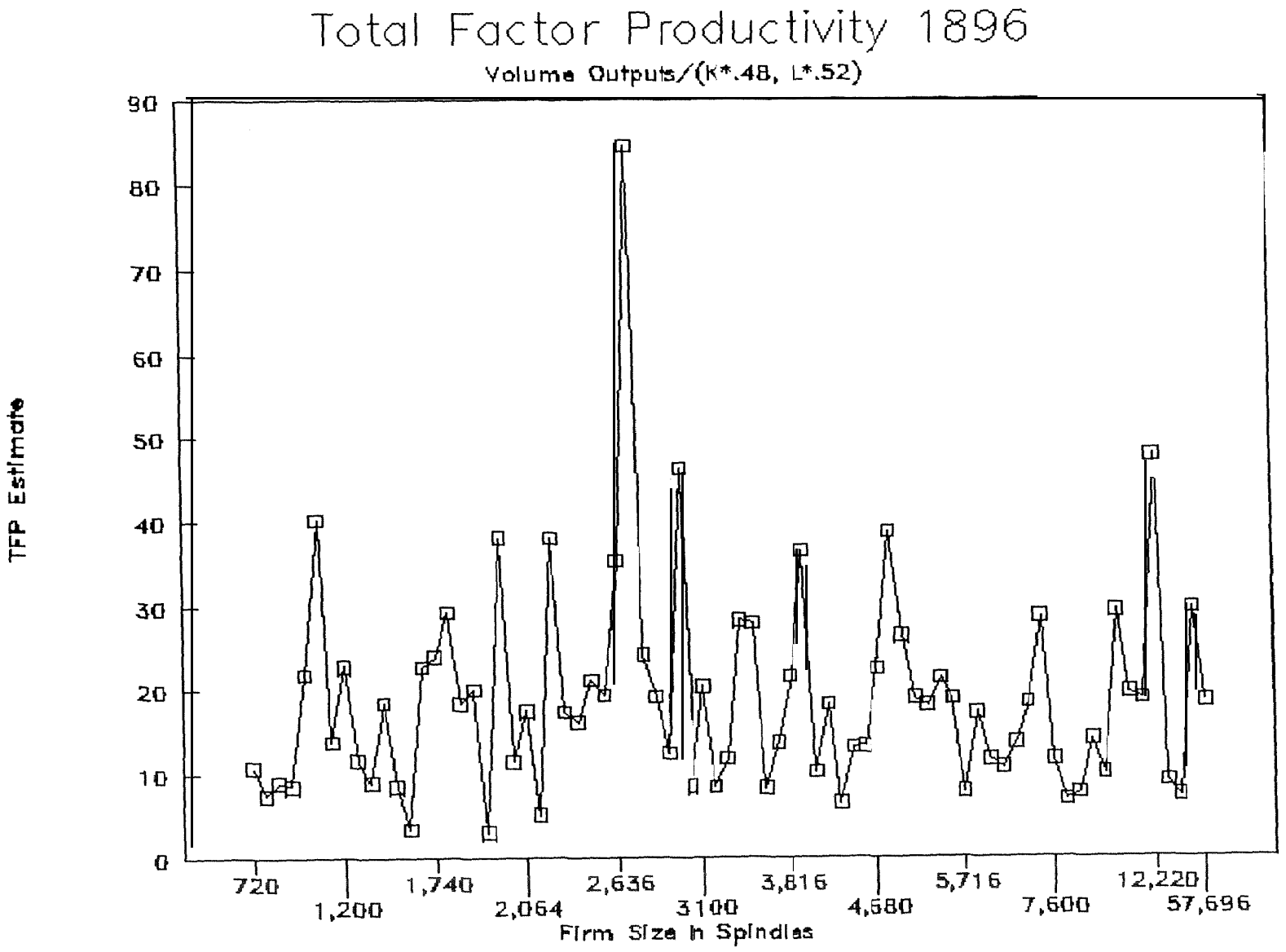

Herfindahl Indices
Brazil and Mexico
Herfindahl Index
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
1843
1850
1860
1870
1880
1890
1900
1910
1920
1930
1934
Year
Mexico
Brazil

GRAPH THREE




Estimated from productionfunction where output is measured in sales, capital as the number of spindles in service an labor as the number of workers employed. Parameter estimates for

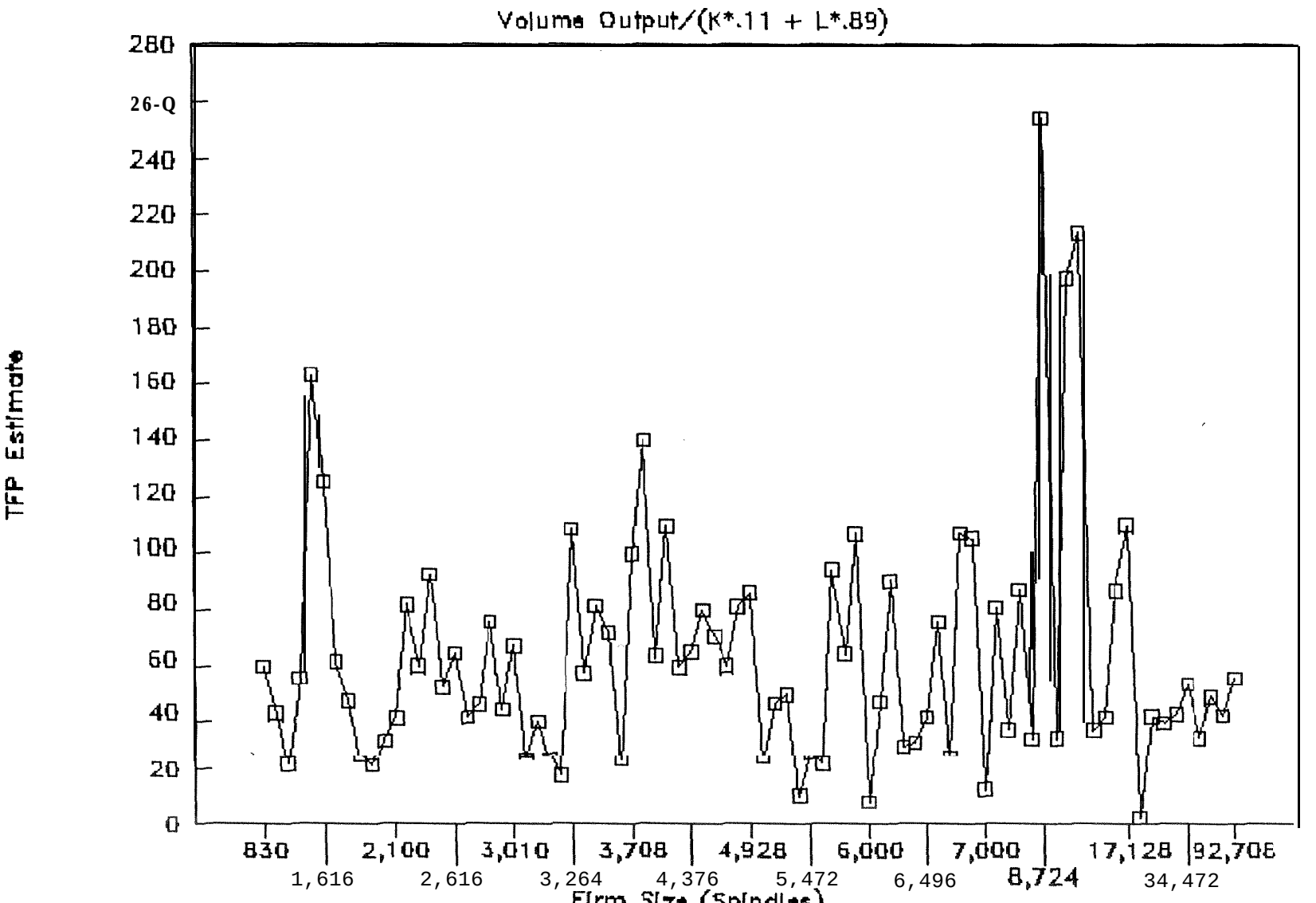
GRAPH FOUR




Estimated from production function where output is measured as pieces of cloth produced, capital as the number of spindles in service and labor as the number of workers employed. Parameter estimates for capital and labor then normalized to 1.00 to weight inputs for estimation of TFP.

GRAPH FIVE

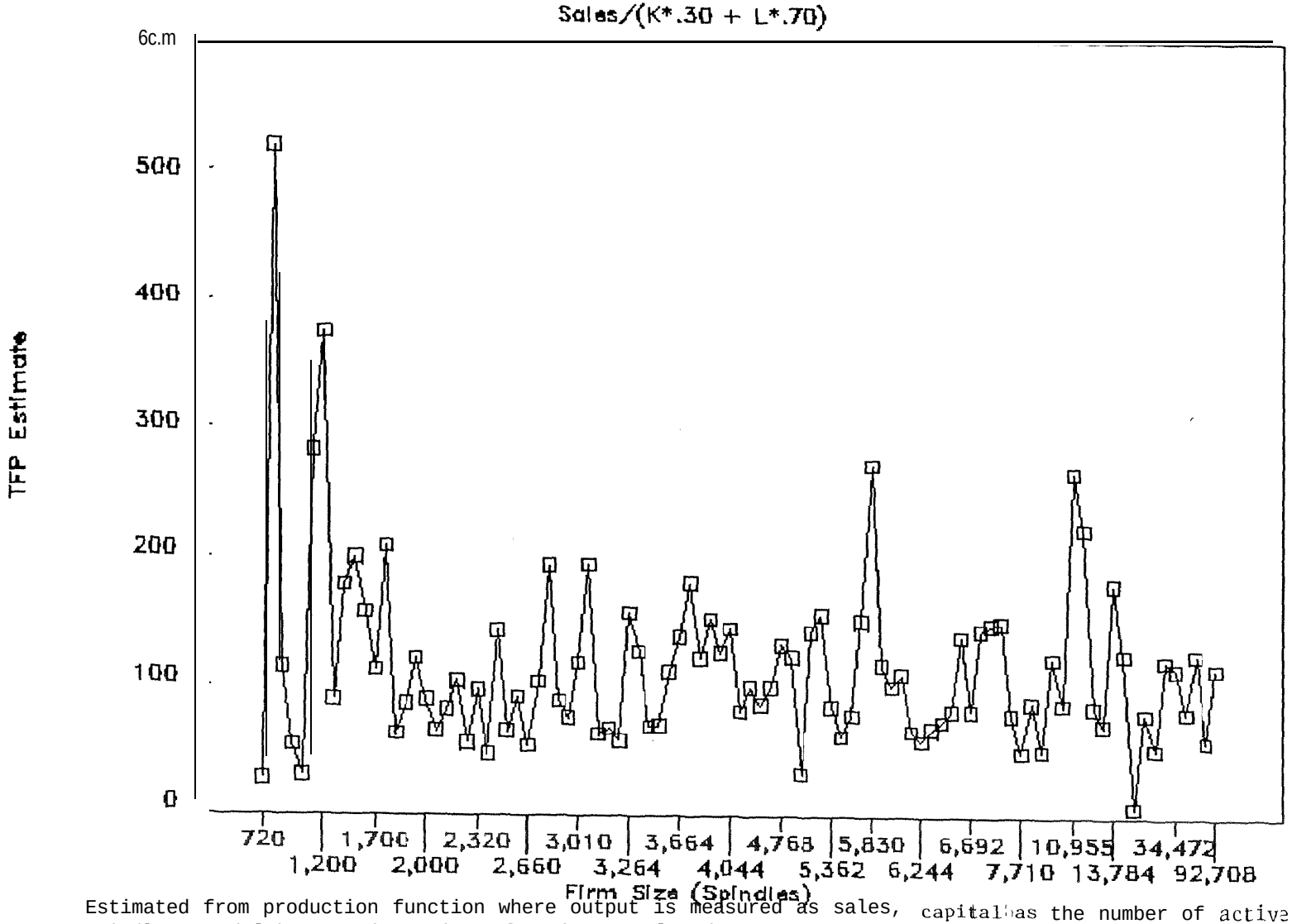
# Total Factor Productivity, Mexico 1912




Estimated from production function where output is measured as pieces of cloth produced, capital as the number of spindles in service and labor as the number of workers employed. Parameter estimates for capital and labor then normalized to 1.00 to weight inputs for estimation of TFP

GRAPH SIX

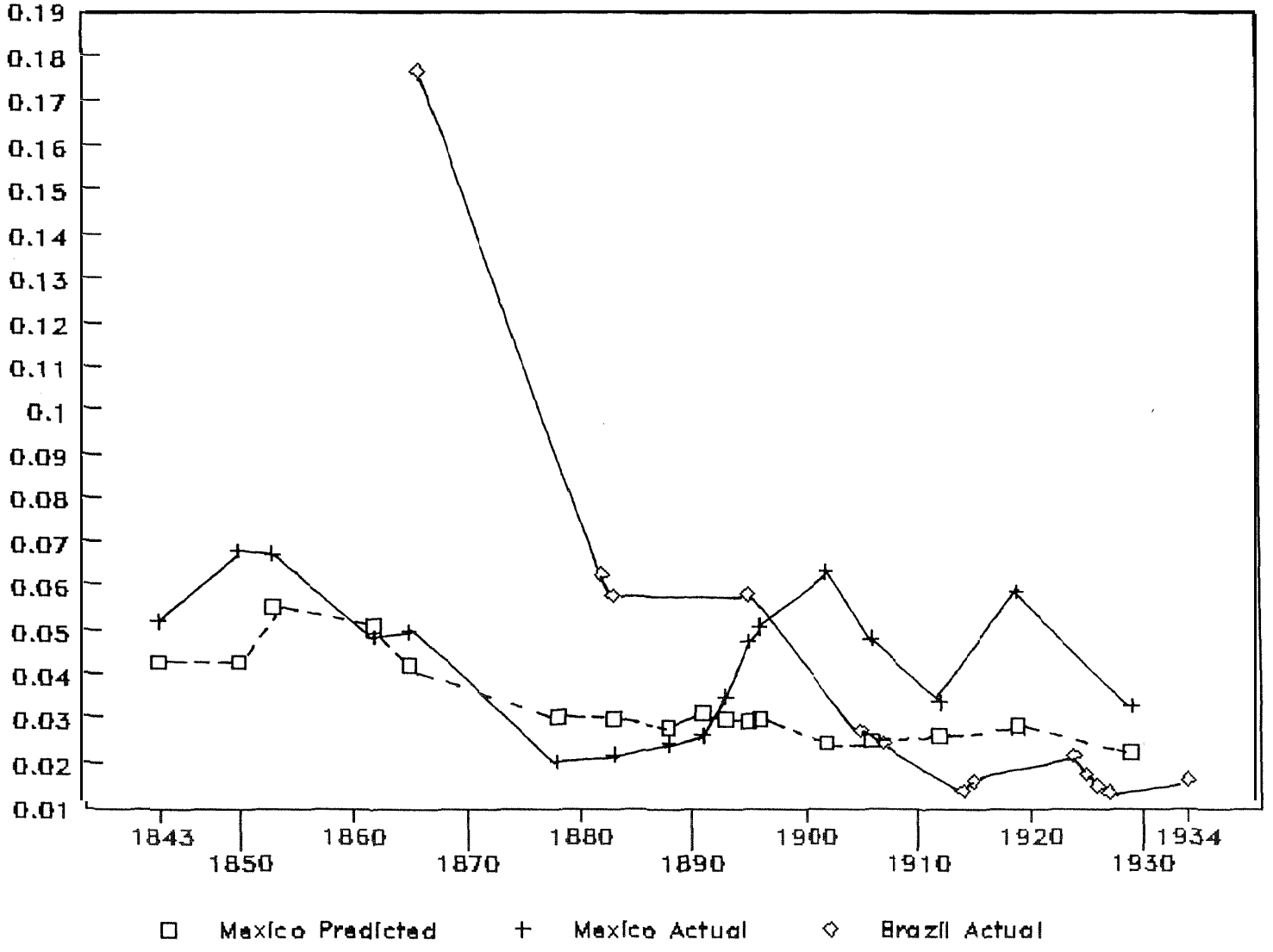
# Total Factor Productivity, Mexico 1912




Estimated from production function where output is measured as sales, capital as the number of active spindles, and labor as the number of workers employed, Paramter estimates then normalized to 1.00 to weight inputs for estimation of TFP.

GRAPH SEVEN

# Herfindahl Indices, Actual & Predicted



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